

Educating Patients On The Use of Insulin Bolus Calculators

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Disclosures

- **Advisory Board Member:** Medtronic Diabetes

Educating Patients On The Use of Insulin Bolus Calculators

My discussion will focus on patients taking insulin via a pen or syringe who are *challenging* such as those *with*:

- Type 2 diabetes who need to intensify their insulin regimen to cover meals
- a history of limited self care
- Low health literacy and numeracy who are not considered to be a candidate for intensive management

Target Population:

How Many People Diagnosed With DM Take Diabetes Medications?

- No Medication:
3 million (14.4%)
- Oral Medications:
11.9 million (57%)



- Insulin Only:
2.9 million
(14%)
- Insulin plus
orals: 3.1
million (14.7%)

DSME: Cornerstone to Care

Diabetes Self-Management Education

- Is a collaborative, interactive, ongoing process
- Develop knowledge and skills needed to ***change behavior***
- Successfully self-managing the disease and its related conditions

Goals of education

- Achieve best health possible
- Better quality of life
- Reduce the need for costly healthcare



- Healthy eating
- Being active
- Monitoring
- Taking medications
- Problem solving
- Healthy coping
- Reducing risks

Numeracy in the US

- *“Ability to understand and use numbers in daily life”*
- >110 million adults have limited numeracy skills
- 2 out of 3 adults cannot do basic math
- People with diabetes need numeracy skills to interpret BG, count carbs and calculate insulin doses



Diabetes Numeracy

- *Diabetes Numeracy Test (DNT), Vanderbilt (2008)*

When given basic diabetes self care tasks:

- 25% of patients could not identify normal BG results from list of BGs
- 56% could not correctly count carbs reading a nutrition facts label
- 59% could not calculate an insulin dose based on current BG and carb intake

Examples of Diabetes Numeracy Test Items and % Correct Responses

Q1. If you ate the entire bag of chips, how many total grams of carbohydrates would you eat?

Nutrition Facts	
Serving size 1 oz (28 g/About 10 chips)	
Servings Per Container 3.5	
Amount Per Serving	
Calories 140	Calories from Fat 60
% Daily Value	
Total Fat 6 g	10%
Saturated Fat 0.5 g	4%
Cholesterol 0 mg	0%
Sodium 150 mg	7%
Total Carbohydrate 18 g	6%

Answer: 63 grams.
Correct response: 44%

Q2. Your target blood sugar is between 60 and 120. Please circle the values below that are in the target range (circle all that apply):

55 145 118

Answer: 118 only.
Correct response: 74%

Q3. You have a prescription for Metformin 500-mg tablets. The label says, "Take 1 tablet with supper each night for the first week. Then, increase by 1 tablet each week for a total of 4 tablets daily with supper." How many tablets should you take with supper each night the second week?

Answer: 2 tablets.
Correct response: 65%

Q4. You check your blood sugar just before eating. You take 1 unit of insulin for every 10 grams of carbohydrates you eat. You are also given the sliding scale shown below. The sliding scale indicates the amount of insulin you should add to your usual dose on the basis of your blood sugar levels:

- If your blood sugar is greater than 120 points at breakfast, lunch, or supper, add 2 units of insulin.
- If your blood sugar is greater than 150 points at breakfast, lunch, or supper, add 4 units of insulin.
- If your blood sugar is greater than 180 points at breakfast, lunch, or supper, add 6 units of insulin.

1 unit of insulin per 10 grams of carbohydrates at meals

If Blood Sugar Is:	Breakfast	Lunch	Supper
>120	+2	+2	+2
>150	+4	+4	+4
>180	+6	+6	+6

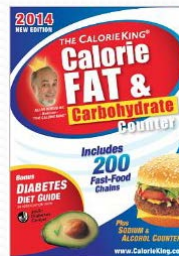
Your blood sugar is 140 and you will eat 50 grams of carbohydrates at lunch. How much total insulin do you need to take?

Answer: 7 units. **Only 33% correctly calculated dose using ICR and simple correction chart**
Correct response: 33%

How To Teach Patients To Calculate A Bolus Insulin Dose

STEP ONE: Count Carbs

- Identify foods that contain carbohydrate e.g. breads, grains, starchy vegetables, beans, fruit, milk, yogurt, “sweets”
- Estimate or *count* number of servings or grams using lists, carb databases, nutrition facts labels



How To Teach Patients To Calculate a Bolus Insulin Dose

STEP TWO: Calculate Insulin Dose

- Use Insulin-to-Carbohydrate Ratio (ICR)
- Start with 1 unit rapid acting insulin for every 15 grams of carb (or each carb serving)

Ex: 58 grams \div 15 = 3.86 units. Take 3 or 4 units?

- “450 Rule” $450 \div$ Total Daily Dose (total all basal, bolus & correction insulin) = ICR

Ex: ICR=10.23, round to 10?, $58 \div 10 = 5.8$,

Take 5 or 6 units?

How To Teach Patients To Calculate a Bolus Insulin Dose

STEP THREE: Calculate Correction Dose

- Insulin Sensitivity Factor (ISF) or correction dose is the amount of insulin needed to lower a high BG back to the target BG
- Start with 1 unit rapid acting insulin for every 50 mg/dl **EX: Current BG 207– target BG 120 = 87 ÷ 50 = 1.74** Take 1 or 2 units? OR
- 1700 Rule: **1700 ÷ Total Daily Dose, 1700 ÷ 44 = 38.64 ISF, 87 ÷ 39 = 2.23**, Take 2 units?

How To Teach Patients To Calculate a Bolus Insulin Dose

STEP Four: Calculate Insulin Dose

- Add Meal and Correction Doses together

Ex: $5.8 + 1.74 = 7.54$

Take 7 units? 8? Consider:

- Fat, fiber, Alcohol
- Physical activity (recent or planned)
- Stress, IOB(?), etc etc



Inter-relationship of All Self-Care Behaviors on Glucose Results

Healthy Eating

Effect of type, amount, frequency, timing of food & alcohol on glucose, special situations

Being Active

Change in type, frequency, duration, or intensity

Reducing Risks

Physical infirmities, gastroparesis, visual impairment, renal function, pregnancy

Taking Medication

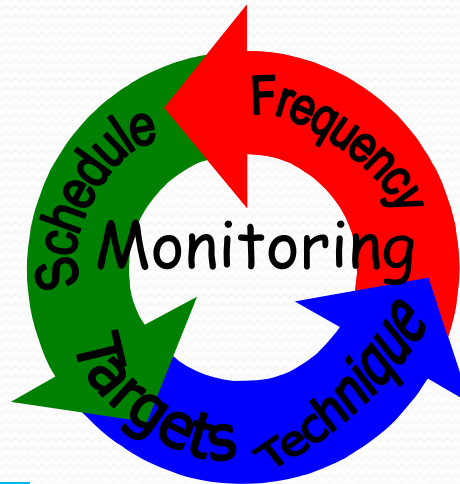
Change in timing, amount, delivery, dose accuracy, lipodystrophy, polypharmacy

Healthy Coping

Stress, change in coping skills, depression, cognition, social isolation

Problem Solving

High or low BG, illness, acute complications, co-morbid conditions



Calculating a Bolus Insulin Dose:

Choose Your Own Math Method

ICR= 1:12 ISF= 45

- Pre-meal BG = 229 mg/dl
- Pre-meal Target= 120 mg/dl
- Total Grams of Carb for meal = 79 gm
- Determine insulin dose:

How would you do the math?

What dose would you recommend??

Calculating a Bolus Insulin Dose:

Choose Your Own Math Method

ICR= 1:12 ISF= 45

- Pre-meal BG = 229 mg/dl
- Pre-meal Target= 120 mg/dl
- Total Grams of Carb for meal = 79 gm

- Determine insulin dose:

Meal: $79 \text{ gms} \div 12 \text{ (ICR)} = 6.58 \text{ units}$

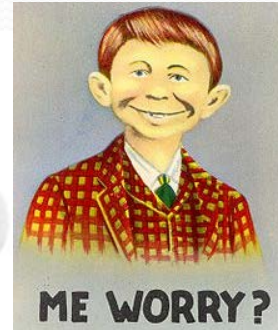
Correction: $229 - 120 = 119 \div 45 = 2.4 \text{ units}$

Total Insulin = $6.58 + 2.4 = 8.98 \text{ units} = 9 \text{ units}$

Calculating a Bolus Insulin Dose:

The Magic Wand Method

- 1) Check BG: 158 mg/dl (*optional*)
- 2) Count Carbs: Maybe 60 grams
- 3) Calculate Insulin Dose: “When I eat a chicken burrito I take 4 units to cover it”



Calculating a Bolus Insulin Dose: The *Einstein* Method

Insulin Dosing for Carbohydrates and High Blood Sugar Correction Guidelines												
Date:	11/9/14				Provider: Donna Tomky, C-NP Phone: 505.262.7455							
Name:					Fax: 505.262.3955							
FOOD		Insulin to Carb Ratio:										
Breakfast:		Your ratio is		1		units of Humalog/Novolog/Apidra for every		8 gms of carb				
Lunch:		Your ratio is		1		units of Humalog/Novolog/Apidra for every		10 gms of carb				
Supper:		Your ratio is		1		units of Humalog/Novolog/Apidra for every		12 gms of carb				
CORRECTION		Correction Factor:										
Day:		Your ratio is		1		units of Humalog/Novolog/Apidra for every		50 mg/dl over 150				
Night:		Your ratio is		1		units of Humalog/Novolog/Apidra for every		75 mg/dl over 200				
Check urine or blood ketones if blood sugar is over 300 mg/dl												
Blood Sugar Correction for Day				+	Total Carbs	Breakfast		Lunch		Supper		
Under	150	=	0	units	8	1	units	1	units	1	units	
151	to	200	=	1	units	16	2	units	2	units	1	units
201	to	250	=	2	units	24	3	units	2	units	2	units
251	to	300	=	3	units	32	4	units	3	units	3	units
301	to	350	=	4	units	40	5	units	4	units	3	units
351	to	400	=	5	units	48	6	units	5	units	4	units
401	to	450	=	6	units	56	7	units	6	units	5	units
451	to	500	=	7	units	64	8	units	6	units	5	units
501	to	550	=	8	units	72	9	units	7	units	6	units
551	to	600	=	9	units	80	10	units	8	units	7	units
Blood Sugar Correction for Night					88	11	units	9	units	7	units	
Under	200	=	0		96	12	units	10	units	8	units	
201	to	275	=	1	units	104	13	units	10	units	9	units
276	to	350	=	2	units	112	14	units	11	units	9	units
276	to	350	=	3	units	120	15	units	12	units	10	units
351	to	425	=	4	units	128	16	units	13	units	11	units
426	to	500	=	5	units	136	17	units	14	units	11	units
501	to	575	=	6	units	144	18	units	14	units	12	units
576	to	650	=	7	units	152	19	units	15	units	13	units
Your (long acting insulin) Lantus / Levemir dose is _____										AM	PM	
If your blood sugar is less than _____ at bedtime eat _____ grams of carbohydrate + 1 ounce of protein												

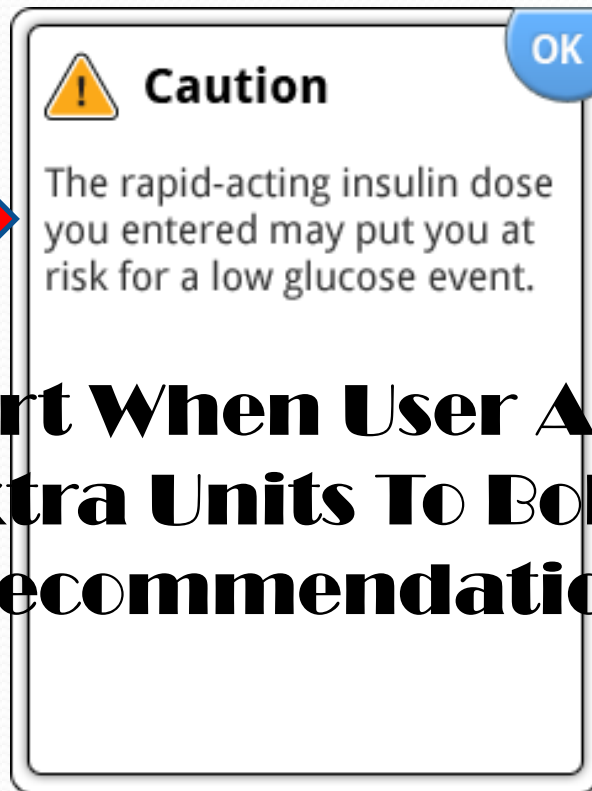
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Calculating a Bolus Insulin Dose: The *Automated* Method

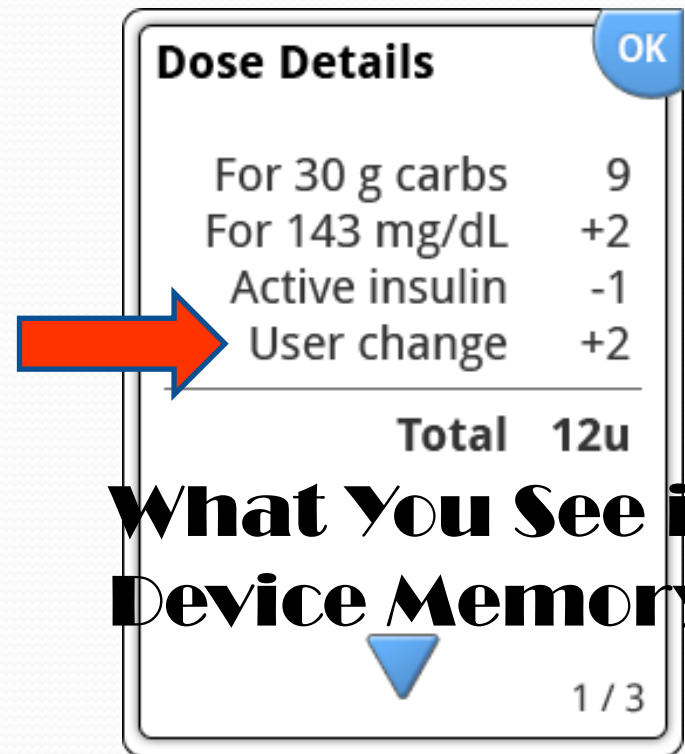
- http://www.freestyleinsulinx.com/video_canada.php



How Can We Make Bolus Calc Devices Safe for Our Patients?



**Alert When User Adds
Extra Units To Bolus
Recommendation**

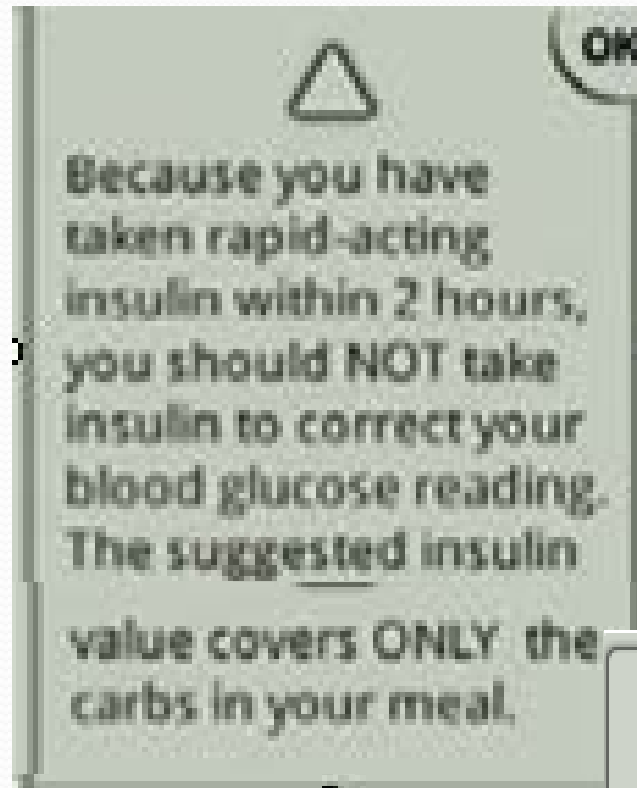


**What You See in
Device Memory**

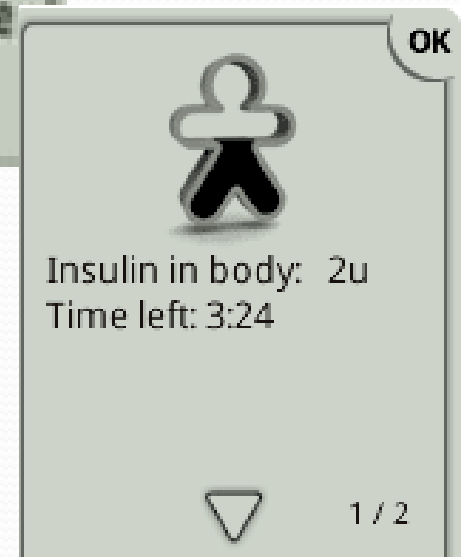
Bonus Features: Treatment Advice



Accu-Chek Aviva Expert®



IOB



Abbott Freestyle InsulinX®

Some Insulin Calculator

Safety Features to Consider

- Currently HCP access code or RX required to setup insulin calculator settings. THIS REQUIREMENT MAY IMPOSE A SIGNIFICANT BARRIER TO ACCESS !!
- **Possible Alternative:** Pack pocket card in box with setting headings pre-printed & spaces to fill in, advise pt to ask HCP to assist by phone, email, fax or in person depending upon pt comfort level with communicating health information and entering it into the device. Pt could take photo of setup with phone & text to HCP to verify.

Some Insulin Calculator Safety Features to Consider

- Device fires *Alert* if patient increases dose
- All dose changes (+/-) in memory to review with patient, can be used to identify patterns, modify ICR & ISF if needed
- Glucose < 70mg/dL – insulin calculator not available
- Must be able to set maximum bolus, should be mandatory

The Bottom Line.....

- Many patients would benefit from guidance when determining insulin dose
- Bolus calculators, especially when added to a diabetes device already being used e.g. glucose meter, promotes adoption of safer methods of calculating an insulin dose
- Bolus calculators based on the algorithms we are currently teaching are safer than patients calculating on their own since they control for numeracy issues and other errors such as wrong BG